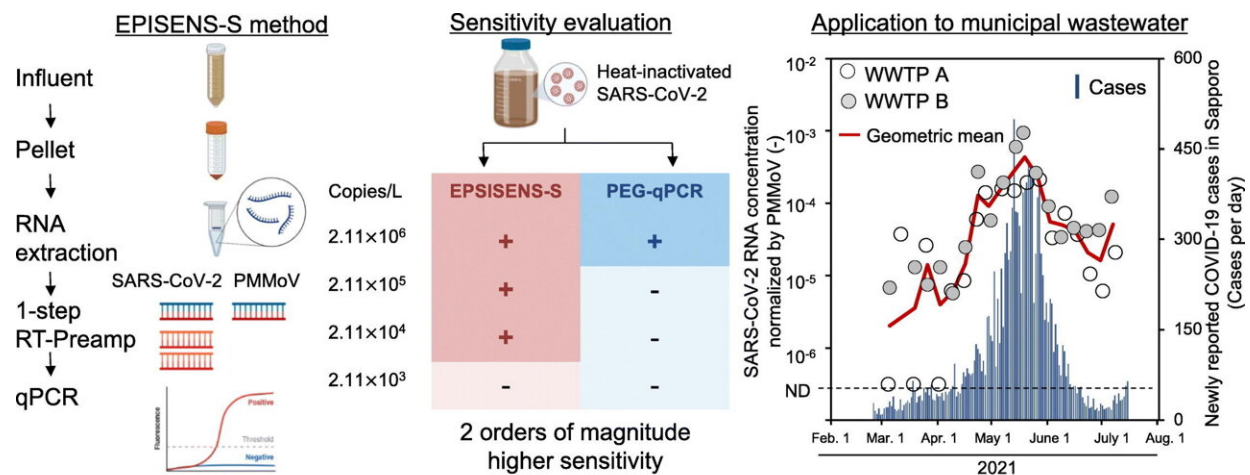


# A rapid, highly sensitive method to measure SARS-CoV-2 in wastewater

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Graphical abstract. Credit: *Science of The Total Environment* (2022). DOI: 10.1016/j.scitotenv.2022.157101

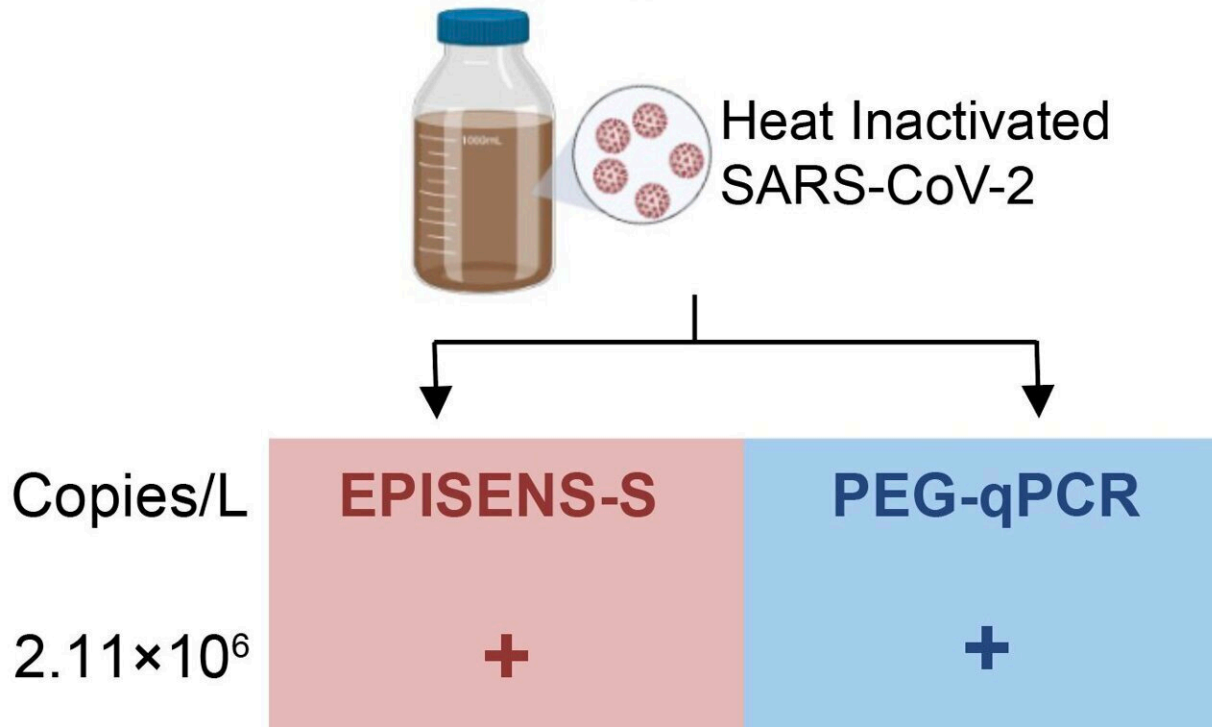
Wastewater-based epidemiology (WBE) has been shown to be an excellent means of understanding the spread of SARS-CoV-2 in communities. It is now used in multiple areas across the world to track the prevalence of the virus, serving as a proxy for determining the status of COVID-19. Of particular importance is that WBE can be used to estimate the prevalence of COVID-19, including asymptomatic cases. However, one of the major drawbacks of WBE for SARS-CoV-2 has been that the traditional method was not very sensitive, and low viral loads could not be reliably detected.

A team of scientists from Hokkaido University and Shionogi & Co, Ltd., have developed a simple, rapid, highly sensitive method for the detection of SARS-CoV-2 in wastewater. The method, EPISENS-S, which does not require specialized equipment, was described in the journal *Science of the Total Environment*.

During the COVID-19 pandemic, Japan has had the lowest number of cases per capita. Thus, the viral loads in [sewage](#) have also been lower, and much more difficult to evaluate using established WBE methods—due to their low sensitivity. Prior work by the research team showed that [the SARS-CoV-2 virus was associated with solids in sewage](#), so they focused on developing a method to analyze the solid phase of wastewater.

The method they developed, EPISENS-S, involves centrifuging collected [wastewater samples](#) to separate all the solids in the samples. The solids were then treated with a commercially available kit to extract all the RNA; the RNA was then reverse transcribed and amplified to obtain a substantial amount of DNA copies. A separate set of samples was subjected to treatment with [polyethylene glycol](#) followed by RNA extraction and reverse transcription to synthesize DNA: the method that is currently widely implemented in Japan. The DNA obtained from each of these methods was subjected to quantitative PCR (qPCR).

## Sensitivity Evaluation



The EPISENS-S method is 100 times (two orders of magnitude) more sensitive than the polyethylene glycol method (PEG-qPCR), the most commonly used method in Japan (Hiroki Ando, et al. *Science of the Total Environment*. August 8, 2022). Credit: Hiroki Ando et al, *Science of the Total Environment*, August 8, 2022

The team found that the EPISENS-S method is approximately 100 times more sensitive than the polyethylene glycol method. They used EPISENS-S to conduct a long-term analysis of wastewater from two [sewage treatment plants](#) in Sapporo city, and found that there was a high correlation between changes in RNA concentrations in the collected samples and changes in the number of reported cases in the city. EPISENS-S can also detect and quantify the Pepper mild mottle virus (PMMoV), which is associated with [fecal matter](#) and is used as an

internal control.

EPISENS-S provides a way to track COVID-19 cases that are asymptomatic, as well as those that have not been clinically confirmed. In addition, it has great potential to continue tracking the prevalence of SARS-CoV-2 as vaccination rates increase. Finally, EPISENS-S could also be adapted to track other viral diseases with low infection numbers and viral loads.

**More information:** Hiroki Ando et al, The Efficient and Practical virus Identification System with ENhanced Sensitivity for Solids (EPISENS-S): A rapid and cost-effective SARS-CoV-2 RNA detection method for routine wastewater surveillance, *Science of The Total Environment* (2022). [DOI: 10.1016/j.scitotenv.2022.157101](https://doi.org/10.1016/j.scitotenv.2022.157101)

Provided by Hokkaido University

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